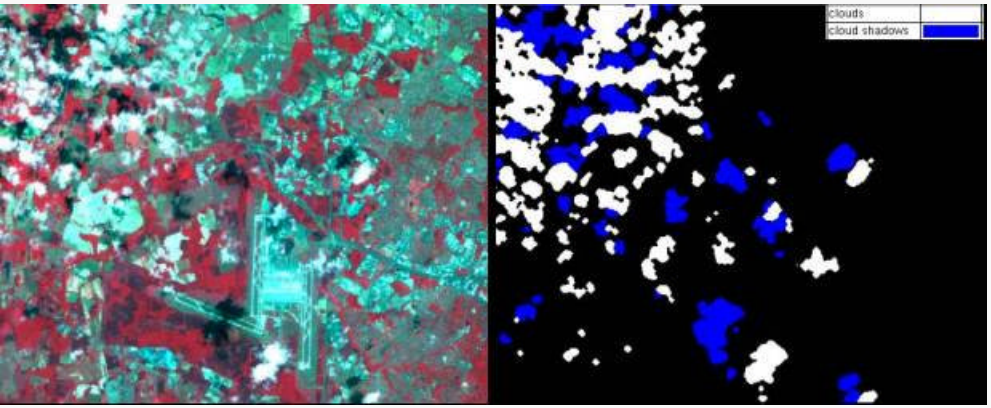
Automated, Universal Software for Cloud and Cloud Shadow Detection in Space- and Air-borne Imagery



NASA SBIR Phase I Proposal

Problem

Limitations with existing cloud cover detection (CCD) techniques for large volume data processing (sensor-specific, require use of thermal band data, don't address cloud shadows, rely on static, universal thresholds, and need ancillary data) and new challenges presented by the increase in the quantity and quality of data in the commercial realm, offer an opportunity for R&D into new and improved methods for both the detection of clouds in acquired imagery and the use of the derived data for cloud cover monitoring and forecasting.

Solution

We propose to develop innovative techniques for the automatic detection and masking of cloud and cloud shadows which will be applicable to a wide range of both commercial and government space and air-borne sensors, and that will overcome most, if not all, the current limitations imposed by existing CCD techniques. Further, we propose to research novel methodologies and inputs to cloud cover monitoring and forecasting by fleshing out the market and requirements for successful commercialization. Our approaches to CCD will be refined by extensive algorithmic testing on a wide variety of data and by consulting with industry experts on their assessment of the applicability of the algorithms to their data and to the needs of their end users.

Proposed System

- Detect not only clouds but cloud shadows as well
- Rely on only B-G-R-NIR bands (no thermal data needed)
- Automated techniques for large volume data processing regardless of the sensor type
- Use spectral and spatial characteristics of clouds and cloud shadows for their identification
- Iterative self-calibrating model

Tasks to be performed

- Develop prototype algorithms for the fully automated detection and masking of cloud and cloud shadows from remotely sensed R-G-B and R-G-B-NIR data
- Test these algorithms on a range of multi-spectral satellite imagery and color aerial photography
- Assess the potential significance of these algorithms for improved data acquisition and data post-processing to specific companies and applications within the RS industry
- Assess the demand and requirements for improved cloud cover forecasting, monitoring, and avoidance strategies
- Prepare the Phase I Final Report

Phase II Extensions

- Customization and implementation testing of the CCD techniques
- Data Recovery and Data Gap Substitution
- Intelligent Data Acquisition: Real-Time On Board CCD
- Improved Cloud Cover Forecasting, Monitoring, and Avoidance

Applications: NASA and non-NASA

- Automatically (100%) update the cloud cover percentage metadata tag (QA/QC)
- Generate a cloud and cloud shadow mask as an additional layer sold to the end-user
- Reschedule failed acquisitions
- Assess cloud cover contamination in real-time mode, i.e. on board, during the data acquisition
- Recover data in transparent cloud shadow areas
- Substitute cloud and cloud shadow pixels representing data loss
- Develop historic cloud cover dataset with spatial and temporal resolutions higher then those currently available
- Monitor cloud cover in near-real time mode and assess its trend
- Forecast cloud cover from historic and actual cloud data
- Formulate reliable cloud avoidance strategies through complimentary use of historical and actual cloud data

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